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भाग 13 क्रान्तिक घटकों में कार्यात्मक परिवर्तनों के लिए आवश्यक परीक्षणों की प्रकृति की अनुशंसा

Indian Standard

METHODS OF TESTS FOR INTERNAL COMBUSTION ENGINES

PART 13 RECOMMENDATIONS ON NATURE OF TESTS REQUIRED FOR FUNCTIONAL CHANGES IN CRITICAL COMPONENTS

ICS 27 020

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

October 2002 **Price Group 4**

Internal Combustion Engines Sectional Committee, TED 9

FOREWORD

This Indian Standard (Part 13) was adopted by the Bureau of Indian Standards, after the draft finalized by the Internal Combustion Engines Sectional Committee had been approved by the Transport Engineering Division Council

The testing and performance requirements of constant and variable speed internal combustion engines were earlier covered by the following Indian Standards

IS No	*Title*
1600 1960	Code for type testing of constant speed internal combustion engines for general purposes
1601 1960	Performance of constant speed internal combustion engines for general purposes
1602 1960	Code for type testing of constant speed internal combustion engines for automotive purposes

These standards which were originally issued in the year 1960 were revised in 1980 and replaced by two sets of standards, one set covering the methods of tests of engines and the other covering the specification and performance requirements of both constant and variable speed engines The standards covering methods of test for internal combustion engines were published in the following 12 parts (each part covering a particular test method or information related to methods of tests)

IS No	*Title*
10000 (Part 1) 1980	Glossary of terms relating to test methods
10000 (Part 2) 1980	Standard reference conditions
10000 (Part 3) 1980	Measurements for testing, units and limits of accuracy
10000 (Part 4) 1980	Declaration of power, efficiency, fuel consumption and lubricating oil consumption
10000 (Part 5) 1980	Preparation for tests and measurements for wear
10000 (Part 6) 1980	Recording of test results
10000 (Part 7) 1980	Governing tests for constant speed engines and selection of engines for use with electrical generators
10000 (Part 8) 1980	Performance tests
10000 (Part 9) 1980	Endurance tests
10000 (Part 10) 1980	Tests for smoke levels, limits and corrections for smoke levels for variable speed compression ignition engines
10000 (Part 11) 1980	Information to be supplied by the purchaser to the manufacturer and information to be supplied by the manufacturer along with the engine
10000 (Part 12) 1980	Specimen test certificates
10001 1981	Performance requirements for constant speed compression ignition (diesel) engines for general purposes (up to 20 kW)
10002 1981	Specification for performance requirements for constant speed compression ignition (diesel) engines for general purposes (above 20 kW)
11170 1985	Specification for performance requirements for constant speed compression ignition (diesel) engines for agricultural purposes (up to 20 kW)

The composition of the Committee responsible for the formulation of this standard is given in Annex A

In the product specification of constant speed compression ignition (diesel) engines (IS 10001, 10002 and 11170), provision is there to carry out tests whenever there is any 'Functional change' in design of the engine or its critical components However, the term 'Functional change' has not been elaborated It was, therefore, felt that guidelines should be available to list the possible changes which may normally be carried out by the manufacturers in critical components and provide recommendations regarding nature of tests required to be performed on the engines when such changes in critical components are done Hence, this standard in the series of 'Methods of test' standards has been brought out as IS 10000 (Part 13)

AMENDMENT NO. 1 DECEMBER 2005
TO
IS 10000 (PART 13) : 2002 METHODS OF TESTS FOR INTERNAL COMBUSTION ENGINES

PART 13 RECOMMENDATIONS ON NATURE OF TESTS REQUIRED FOR FUNCTION AL CHANGES IN CRITICAL COMPONENTS

(*Page* 1, *clause* **4.3**) — Substitute the following for the existing

'**4.3** Seven endurance cycles as per **2.1.1** of IS 10000 (Part 9) and performance test as per **2.1.3** and **2.1.3.1** of IS 10000 (Part 8) '

(TED 2)

Reprography Unit, BIS, New Delhi, India

Indian Standard

METHODS OF TESTS FOR INTERNAL COMBUSTION ENGINES

PART 13 RECOMMENDATIONS ON NATURE OF TESTS REQUIRED FOR FUNCTIONAL CHANGES IN CRITICAL COMPONENTS

1 SCOPE

This standard (Part 13) provides recommendations on nature of tests required to be carried out due to any functional changes in the testing of the critical components of constant speed compression ignition (diesel) engine for general and agricultural purposes as per IS 10001 and IS 11170 respectively The critical components are listed in 3.1.1 of IS 10001 and IS 11170

2 REFERENCES

The following Indian Standards contain provisions, which through reference in this text, constitute provisions of this standard At the time of publication the editions indicated were valid All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below

IS No	*Title*
25 1979	Antifriction bearing alloys (*third revision*)
810 1991	Engine valves (*second revision*)
5791 1986	Technical supply conditions for piston rings for internal combustion engines (*second revision*)
6740 1985	Gudgeon pins for internal combustion engines (*first revision*)
7494 1981	Steel for valves for internal combustion engines (*first revision*)
8422 1977	Piston rings for internal combustion engines

3 DEFINITIONS

3.1 The definitions given in IS 10000 (Part 1) and the following shall apply

3.1.1 *Functional Change*

3.1.1.1 Any change in the design of a component which may either effect the other mating components, or the performance or operation of the engine, shall be considered a functional change

Examples

a) Change in the bore dimension of the bearing, and

b) Change in the bore of the liner

3.1.1.2 Style changes shall not be considered a functional change

4 CATEGORIES OF TESTS

4.1 Type Tests

As per 3.1 of IS 11170 and IS 10001

4.2 Performance Tests

As per 2.1.3 and 2.1.3.1 of IS 10000 (Part 8)

4.3 Endurance Cycles

As per 2.1.1 of IS 10000 (Part 9) and performance test as per 2.1.3 and 2.1.3.1 of IS 10000 (Part 8)

5 NATURE OF TESTS RECOMMENDED FOR FUNCTIONAL CHANGE IN CRITICAL COMPONENTS LISTED IN 3.1.1 OF IS 10001 AND IS 11170

Components	*Functional Change*	*Nature of Test Ref to Clause*
i) Cylinder Head	a) Lowering the grade of casting	4.1
	b) Decrease in number of stud holes or reduction in nominal basic size of cylinder head stud bolts fixed with crankcase or cylinder block	4.1
	c) Change in combustion design pattern	4.1
	d) Change in inlet and exhaust port pattern or dimensions	4.1
	e) Change in position or pattern of air swirl	4.2
	f) Change in nozzle and nozzle holder bore	4.2
	g) Increase in wall thickness without affecting cooling	4.2
	h) Any other change	No specific test
ii) Crankcase	a) Lowering the grade of casting	4.1
	b) Reduction in nominal bearing bore for crankshaft journal, camshaft journal where crankcase bore acts as bearing	4.1
	c) Decrease in number of stud holes or set bolt holes of reduction in its nominal size for main bearing housings, cylinder block, cylinder heads camshaft side cover	4.1
	d) Decrease in lubricating oil sump capacity	4.3
	e) Any other change	No specific test
iii) Cylinder Block	a) Lowering the grade of casting	4.1
	b) Decrease in number of stud holes or reduction in nominal basic size of cylinder head studs	4.1
	c) Change in nominal bore size where it acts as liner bore for piston	4.1
	d) Change in surface treatment where it acts as liner bore for improvement in wear pattern	4.2
	e) Any other change	No specific test
iv) Inlet and Exhaust Valve	a) Lowering the grade of material of inlet and exhaust valve which does not conform to IS 810 or IS 7494	4.1
	b) Lowering the grade of material of inlet and exhaust valve which conform to IS 810 or IS 7494	4.2
v) Cylinder Liner	a) Lowering the grade of material	4.1
	b) Change in surface treatment of liner bore for improvement in wear pattern	4.2
	c) Change in nominal size of liner bore	4.1
	d) Any other change	No specific test
vi) Valve Guide	a) Lowering the grade of material	4.1
	b) Reduction in bore for valve stem	4.1
	c) Reduction in valve guide outside nominal diameter when fitted in cylinder head	4.2
	d) Any other change	No specific test

Components		*Functional Change*	*Nature of Test, Ref to Clause*
vii) Valve Rocker Arms	a)	Lowering the grade of material or change in material lowering its strength	4 1
	b)	Reduction in nominal bore if it acts as bearing for rocker shaft	4 2
	c)	Any other change	No specific test
viii) Valve Tappets	a)	Lowering the grade of material or change in material lowering its strength	4 1
	b)	Change in valve tappet head diameter or change in valve tappet outside diameter	4 2
	c)	Any other change	No specific test
ix) Piston Ring Compression Ring Oil Scrapper Ring	a)	Lowering the grade of material which does not conform to IS 8422 or IS 5791 for piston ring	4 1
	b)	Lowering the grade of material which conform to IS 8422 or IS 5791 for piston ring	4 2
	c)	Reduction in nominal axial width	4 1
	d)	Reduction in nominal radial thickness	4 1
	e)	Change in closed gap	4 1
	f)	Change in type of oil ring such as oil saver ring, change in end joints change from plain ring to napier ring	4 3
	g)	Any other change	No specific test
x) Piston	a)	Lowering the grade of material	4 1
	b)	Reduction in nominal axial width of piston ring groove	4 1
	c)	Reduction in nominal bore for gudgeon pin	4 1
	d)	Decreasing the number of compression or oil scrapper ring groove in the piston	4 1
	e)	Change in layout of piston ring grooves	4 2
	f)	Increase in piston ring groove diameter	4 2
	g)	Change in forms of piston with respect to taper and ovality	4 3
	h)	Change in basic design of combustion chamber for direct injection or partial direct injection engine	4 3
	j)	Any other change	No specific test
xi) Gudgeon Pin	a)	Lowering the grade of material which does not conform to IS 6740 for gudgeon pin	4 1
	b)	Lowering the grade of material which conform to IS 6740 for gudgeon pin	4 2
	c)	Reduction in nominal outside diameter of gudgeon pin	4 1
	d)	Increase in nominal bore size of the gudgeon pin or reduction in nominal wall thickness of gudgeon pin	4 1
	e)	Any other change	No specific test
xii) Connecting Rod	a)	Lowering the grade of material or lowering the connecting rod strength	4 1
	b)	Lowering the nominal cross-section of the connecting rod	4 1

Components		*Functional Change*	*Nature of Test, Ref to Clause*
	c)	Reduction in nominal big end bearing bore	4.1
	d)	Any other change	No specific test
xiii) Connecting Rod Bolt/Nut	a)	Change in material specification on lower side	4.1
	b)	Reduction in nominal thread size	4.1
	c)	Change in surface treatment	4.3
	d)	Any other change	No specific test
xiv) Crankshaft	a)	Change in material specification on lower side or lowering the strength	4.1
	b)	Reduction in nominal diameter for main bearing journal or for crankpin	4.1
	c)	Reduction in number of balance weight, weight bolt holes or change in thread size of balance weight Bolts on lower side	4.1
	d)	Change in surface treatment to main bearing journal or crankpin such as induction hardening from unhardened to harden the journals	4.3
	e)	Change in diameter for oil seal	4.2
	f)	Reduction in flywheel key way slot size	4.3
	g)	Reduction in crank web size	4.1
	h)	Change in nominal size of the crank throw	4.3
	j)	Any other change	No specific test
xv) Main Bearing	a)	Lowering the bearing lining material which does not conform to IS 25 for bearing	4.1
	b)	Lowering the bearing lining material which conform to IS 25 for bearing with corresponding surface treatment of journals	4.3
	c)	Lowering the nominal bearing bore in case of bush bearing is used as main bearing OR Lowering the taper roller bearing size in case taper roller bearing acts as main bearing or big end bearing	4.1
	d)	Any other change	No specific test
xvi) Big End Bearing and Small End Bearing for Connecting Rod	a)	Lowering the bearing lining material which does not conform to IS 25 for bearing	4.1
	b)	Lowering the bearing lining material which conform to IS 25 for bearing with corresponding surface treatment of crankpin of crankshaft and gudgeon pin	4.3
	c)	Reduction in nominal bearing bore	4.1
	d)	Any other change	No specific test
xvii) Camshaft/Cams/Cam Bearing/Timing Gears	a)	Lowering the material of camshaft, cams, cam bearing and timing gears which do not conform to respective Indian Standards	4.1
	b)	Lowering the material of camshaft, cams, cam bearing and timing gears which conforms to respective Indian Standards	4.2

Components		*Functional Change*	*Nature of Test Ref to Clause*
	c)	Change in profile of cams (in case of individual cams or integral camshaft) or change in position of relative angles between cams	4.3
	d)	Change of steel timing gears (from where drive is not taken) to cast iron casting gears or from cast iron timing gears to steel timing gears	4.3
	e)	Change in tooth profile of timing gears and change in number of tooth of timing gears	4.3
	f)	Any other change	No specific test
xviii) Valve Spring Governor Springs and Fuel Pump Rack Springs	a)	Change in stiffness of the Spring	4.3
	b)	Change in material of the springs	4.3
	c)	Change in free length of the springs	4.2
	d)	Change in gauge of the wire of springs or change in number of effective turns of the springs	4.3
	e)	Any other change	No specific test
xix) High Pressure Fuel Pipe	a)	Change in size of the injection hole of high pressure fuel pipe	4.3
	b)	Any other change	No specific test
xx) Fuel Injection Equipment		Any change in fuel pump or injector	4.3
xxi) Lubricating Oil Pump	a)	Lowering the grade of material or plunger in case of plunger type lubricating oil pump or gears in case of gear type lubricating oil pump or lob in case of lob type lubricating oil pump	4.1
	b)	Change from plunger type lubricating oil pump to gear type lubricating oil pump or from gear type lubricating oil pump to plunger type lubricating oil pump	4.3
	c)	Change from gear type or plunger type lubricating oil pump to lob type lubricating oil pump or from lob type lubricating oil pump to plunger or gear type lubricating oil pumps	4.3
	d)	Change in nominal size of plunger or plunger oil pump or number of teeth of gears for gear oil pump or change in shape of lob for lob type oil pump	4.3
	e)	Any other change	No specific test
xxii) Cylinder Head Gasket	a)	Change in material of cylinder head gasket	4.3
	b)	Any other change	No specific test
xxiii) Governor Weight		Any change in governor weight	4.3

NOTES

1 If any functional change of critical parts listed in 5.1 to 5.23 is tested as per nature of prescribed test in this standard the same functional change may be permitted to any other manufacturer subject to their basic engine is type tested as per 3.1 of IS 11170 or IS 10001 provided the manufacturer submits the proof of the test for particular functional change of critical part

2 If any functional change of standard original equipment like fuel injection equipment, piston, piston ring set, bearings, valves, etc, and that change is for improvement in engine performance and if this functional change is subjected to respective nature of tests prescribed in this standard carried out by a manufacturer, same functional change may be adopted by any other manufacturer who desires to adopt it without going in for any test

3 If any change in fits, tolerances is done without affecting the nominal dimensions, keeping clearance fit, interference fit, shrink fit, transition fit, force or press fit, etc, as per previous drawings, same change may be permitted without any test

4 In case of multi-cylinder diesel engines of modular design construction where all the models are already type approved and functional change related to common parts/modular design construction are type approved on any one of the models, same functional change on these components may also be considered as type approved for other engine models of the same series having same or lower BMEP rating

5 If any functional change of critical parts is tested as per nature of prescribed test in this standard on higher rating of the engine, same change may also be considered as approved for lower rating of that engine

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Internal Combustion Engines Sectional Committee, TED 9

Organization	*Representative(s)*
Kirloskar Oil Engines Ltd, Pune	Shri S G Sardesai (***Chairman***) Shri C G Ranade (*Alternate*)
Ashok Leyland Ltd, Chennai	Shri N Sankarasubramanian Shri M Nirmal Kumar (*Alternate*)
Automotive Research Association of India, Pune	Shri M K Chaudhari Shri S Bhattacharya (*Alternate*)
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Diesel Locomotive Works, Varanasi	Chief Design Engineer/DLW Chief Mechanical Engineer/Design (*Alternate*)
Directorate General of Supplies and Disposals, New Delhi	Shri V K Sridhar Shri S K Agarwal (*Alternate*)
Garden Reach Ship Builders and Engineers, Kolkata	Representative
Greaves Ltd (Diesel Engine Unit), Pune	Shri W N Khatavkar Shri A S Patil (*Alternate*)
Greaves Ltd (Business Group 3) Portable Engines, Chennai	Shri H K Acharya Shri S K Kartikeyan (*Alternate*)
Indian Diesel Engine Manufacturers Association, Dehra Dun	Shri W N Khatoker Shri S G Sardesai (*Alternate*)
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Research Design and Standards Organization, Lucknow	Director (T)
Shriram Honda Power Equipment Ltd, New Delhi	Shri L Subramaniam Shri G Marathe (*Alternate*)

(*Continued on page 8*)

(*Continued from page 7*)

Organization	*Representative(s)*
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Tata Engineering and Locomotive Company Limited, Pune	Representative
The National Small Industries Corporation Ltd, New Delhi	Shri M Sairam Shri M Gopalakrishnan (*Alternate*)
U P Diesel Engine Manufacturer's Association, Agra	Shri R P Agarwal Shri Ravi Agarwal (*Alternate*)
University of Jodhpur, Jodhpur	Shri B P Jain
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Shri A K Nagpal
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